U. S. DEPARTMENT OF AGRICULTURE.

REPORT

OF

THE BOTANIST

FOR

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BY

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REPORT OF THE BOTANIST.

U. S. Department of Agriculture,
Division of Botany,
Washington, D. C., September 10, 1896.

Sir: I have the honor to submit herewith my fourth annual report of the operations of the Division of Botany, covering the period from July 1, 1895, to June 30, 1896.

Respectfully,

Frederick V. Coville,
Botanist.

Hon. J. Sterling Morton,
Secretary.

WORK OF THE YEAR.

INTRODUCTION.

The progress of the Division of Botany in the fiscal year 1896 may be briefly characterized as showing increased efficiency in the divisional staff, an increase in productive capacity as evidenced by the publications issued, and an increase in the relative amount of money devoted to investigations. In private institutions which are carrying on research work the proportion of money paid for clerical services is relatively small, but in governmental establishments it is commonly large, and there is a constant tendency toward such an increase of clerical assistants as to be a serious drain on funds primarily intended for research work. It is gratifying therefore to be able to record that, at the close of the fiscal year 1896, 62 per cent of the money devoted to salaries was being paid to investigators, men who had received careful special training for their work. This, when compared with the percentages for the three preceding years, shows a continued improvement, for, at the end of the fiscal year 1893, 35 per cent was being paid to investigators; in 1894, 42 per cent; and in 1895, 57 per cent.

One general feature deserving particular mention is the policy of detailing for special field work the various assistants in the division, when such field work is required, instead of appointing temporary special field agents for the purpose. During the past year this has been practiced as far as possible, and the results not only warrant a continuance of the plan, but demonstrate conclusively its positive benefits to the Department. An assistant on the regular staff, from his office experience and his consequent knowledge of the exact kind of information desired, is usually better equipped for such field work than a casual appointee, even though the latter may have an equal

technical education. Furthermore, the information absorbed by an intelligent assistant while in the field is seldom confined to the particular subject which he is sent out to investigate and upon which he presents his report. He learns a great many other facts bearing on botanical agricultural questions, and these, while not included in his report, are often of the greatest importance in other subsequent investigations. In the case of a temporary special agent only the written report on a specified subject is put on file, and a great deal of valuable accessory information is lost. Essentially, the assistants constitute a trained corps of experts in various lines whom the Government pays to furnish information valuable for the promotion of agriculture. Most of them are young men who presumably will remain many years in the service, and the Government can well afford to give them the means for maintaining the best possible equipment.

NATIONAL HERBARIUM.

During the fiscal year 1895, as stated in my last report, about three-fourths of the National Herbarium was moved from the Department building to fireproof quarters in the National Museum. Since that time an additional balcony has been provided by the Museum authorities, and all the remainder of the herbarium proper in the custody of the Division of Botany, with the exception of the Coniferae, has been transferred to the Museum. It is hoped that before the end of the fiscal year 1897 space will be provided for the final transfer of the remaining portion of the collections.

For several years it has been felt by the Department that the increasing cost of maintaining the herbarium required too large an expenditure of the funds appropriated for botanical investigations and experiments, and it is a pleasure now to announce that, following the transfer of the herbarium to the actual custody of the National Museum, the appropriations of that institution have been sufficiently increased to enable it to assume the financial responsibility of the care and maintenance of the herbarium. The Department of Agriculture, therefore, is entirely relieved of accountability in this direction. It is a pleasure also to report that the National Museum has appointed on its herbarium staff Dr. J. N. Rose and Mr. C. L. Pollard, formerly assistant botanist and assistant curator, respectively, in the Division of Botany, together with the force of clerks and mounters heretofore employed on the herbarium, the botanist of the Department retaining, with the consent of the Secretary of Agriculture, the position of honorary curator of the herbarium under the National Museum.

WEED INVESTIGATIONS.

The work in weed investigations has been carried on along the following lines: (1) furnishing information to farmers who have sent weeds to the Department with requests for their identification and for advice regarding their treatment; (2) collecting and recording information of every kind about weeds; (3) warning State experiment stations and local authorities of the presence of dangerous weeds in their respective States or localities; (4) preparing manuscript for publication.

Plants have been received from all parts of the United States with requests for information in regard to their names, characteristics, and methods of eradication. To all of these requests replies are made by

letter or printed circular. The plants about which the greatest number of complaints have been received during the past year are Canada thistle (*Carduus arvensis*), wild onion (*Allium vineale*), bull nettle (*Solanum elaeagnifolium*), Johnson grass (*Andropogon halepensis*), penny cress (*Thlaspi arvense*), and sand bur (*Cenchrus tribuloides*).

Information has been collected about nearly all the most injurious weeds of the United States and recorded or tabulated for future use. It includes notes upon their present distribution, means and routes of introduction, and rapidity of dissemination, and upon methods of eradication that have been tried, either successfully or unsuccessfully.

In connection with the work of revising the mailing list of the Division of Botany a circular was sent to each address requesting special information in regard to certain bad weeds. The returns from these circulars have been collated and recorded, and the distribution of the several species has been platted upon maps. By this means very accurate information in regard to the geographic distribution of these plants has been obtained in such form as to indicate in what regions they are likely to become troublesome hereafter and where they may be neglected without danger. A base map has been designed and printed upon which these facts of plant distribution may be platted, ready for reproduction by photo-engraving.

During the past fiscal year the officers of the State experiment stations or the State departments of agriculture in five States have received from this Department their first warning of the presence, in their territory or in dangerous proximity, of the Russian thistle. In each case these warnings met with a hearty response, and active measures were adopted to exterminate or prevent the further spread of the plant. State authorities in some of the States have also been notified of the introduction of tumbling mustard, woolly mullein, and other dangerous weeds. These timely warnings have already produced good results, and much benefit may be expected in future from a free exchange of information with the proper local authorities toward the adoption of measures to prevent dangerous weeds from becoming established in this country or in new regions.

Papers have been prepared for publication as follows: Circular No. 3, revised, Russian Thistle; Bulletin No. 17, Legislation against Weeds; Table of Two Hundred Weeds, published in the Yearbook for 1895; Circular No. 7, Tumbling Mustard; and Circular No. 9, Canada Thistle, nearly ready for publication.

SEED LABORATORY.

The investigations in the seed laboratory have been interrupted during the year by two large pieces of work, the preparation of an exhibit for the Atlanta Exposition and the testing of the seeds purchased by the Department of Agriculture for distribution in the spring and early summer of 1896. During May and June almost the entire time of Mr. Hicks and his assistants was devoted to testing and reporting upon the seeds purchased by the Department for Congressional distribution. Tests to the number of 2,230 were made, covering 129 varieties of vegetable seeds and 65 varieties of flower seeds. This large number of trials was made necessary by the fact that the seed was tested by several methods in order to throw light upon the conditions best suited for the germination of different varieties. A full report upon these tests has been completed and submitted to the Department authorities.

The annual report for 1894 recommended the elaboration and adoption of some system of grading seeds numerically, instead of using such trade names as "prime," "extra prime," and "choice," which always have a varying value. The experiments thus far conducted by the seed laboratory and the determination of the Department authorities this year to secure good seed have furnished the means and the occasion for issuing a series of such numerical grades, with tentative standards for each variety. It is believed that by this means we shall be able to designate much more accurately than heretofore for trade purposes the real value of any lot of seeds placed upon the market.

The clover seed investigation begun in the summer of 1894 has been continued so far as the interruptions of other urgent work permitted. In July, 1895, Mr. Hicks made a trip to a portion of the clover-seed districts of Wisconsin, Minnesota, Kansas, and Missouri, visiting the principal seedsmen in Chicago, St. Paul, Milwaukee, Minneapolis, Kansas City, and St. Louis, directing his attention while in Wisconsin particularly to the study of alsike clover. From January to April, 1896, Mr. Pieters made 371 germination tests of clover seed obtained the preceding season from American farmers and seedsmen. The work on this subject will be pushed to completion during the next few months unless other unforeseen interruptions arise.

Two illustrated articles were furnished for the 1895 Yearbook, one by Mr. Hicks on "Oil-producing seeds," and one by Mr. Pieters on "Testing seeds at home." A four-page circular by Mr. Hicks on standards of the purity and vitality of agricultural seeds has also been issued.

The equipment of the seed laboratory has been improved in several directions during the past year. Bottles of seeds to the number of 2,685 have been added to the seed collection. Of these 921 were received from the Royal Botanic Garden, Dublin; 282 were obtained in California, while most of the remainder were added by local collectors, largely by members of the division working in the vicinity of Washington. The total number of specimens now in the seed collection is 10,123. In addition to seeds, about 200 alcoholic specimens of seedlings and fruits have been secured, as well as a set of herbarium specimens of seedlings grown in the Department greenhouses.

The work of abstracting seed literature has been continued until the cards have now reached the number of 2,296. The value of these abstracts, which are arranged in index form, is constantly apparent.

In addition to the greenhouse space which was turned over to the Division of Botany at about the close of the fiscal year 1895, and which throughout the year has been indispensable in conducting our various seed tests, a small but much-needed out-door space was placed at our disposal in the spring of the present season. This has been devoted chiefly to experiments on the relative yielding capacity of seeds selected with respect to size. Neither the greenhouse nor the out-door space now available, however, is at all sufficient for the needs of our present investigations.

The laboratory has been enlarged by the addition of one room fitted up for an office and a second basement room devoted to general experimental work. The principal increase in apparatus has been a sterilizing chamber for sand, pots, etc., a specific-gravity balance, a Vienna germinating chamber, a Swedish seed-preparing machine, a clover seed investigating machine, an apparatus for use in testing grass seeds, and an instrument for ascertaining the proportion of oily and mealy grains in a specified sample.

POISONOUS PLANTS.

The work of the past year has been devoted largely to the development and extension of certain fundamental requirements, the increase of the library and reference collection of drugs, the broadening of the correspondence on poisonous plants, and the extension of the card index on this subject. This last work was pursued with the double object of facilitating the answering of current letters of inquiry and the acquisition of material for the ultimate publication of a manual on the poisonous plants of the United States. Over 1,000 cards have already been collected from the scientific and popular literature of botany, chemistry, physiology, and toxicology.

Special attention has been paid bibliographically to the collection of data in regard to the poisonous species of two families of plants, the *Ericaceae* and the *Anacardiaceae*. Information regarding the former has also been augmented through correspondence and by experimentation. An extended report has been prepared, but the work of investigation is not yet complete. The results obtained up to date show that a chemical antidote has been found for andromedotoxin, the poisonous constituent of poison laurel (*Kalmia latifolia*) and other plants of the family *Ericaceae*. The utility of this antidote has thus far been shown only in the laboratory by chemical experiments and by experiments on guinea pigs; but its usefulness with larger animals, especially those like cattle and sheep, which live on bulky foods, is yet to be demonstrated.

The experimental work on the *Anacardiaceae*, the family to which poison ivy (*Rhus radicans*) belongs, was confined to a verification of the results of other recent investigators on the properties of the poisonous principle, toxicodendrol. Large quantities of toxicodendrol were also shown to exist in *Rhus potentillaefolia*, a species of poison oak lately rediscovered in Mexico.

Two toxicological experiments were tried with extracts from a native species of flax (*Linum rigidum*), which we are informed is killing sheep in Texas. The results were affirmative, although the plant has not been generally recognized as poisonous.

Cases of poisoning involving over a dozen plants in other families have been presented by correspondents for consideration and advice. Four of these caused nearly fatal catastrophes to nine individuals; the others were fatal to animals. Four groups of species are especially interesting on account of the extent of the damage they inflict. These are the loco weeds (*Spiesia* and *Astragalus*), the poison laurels (*Kalmia*, *Rhododendron*, and *Azalea*), the larkspur (*Delphinium*), and the sneeze weed (*Helenium autumnale*). All are reported to be killing cattle by the hundreds. *Cicuta vagans*, a little known plant related to poison hemlock, is also killing many cattle in northern California, Oregon, and Washington. All these plants need careful investigation.

PLANT RESOURCES.

In the season of 1895 two field agents were employed for work in Idaho, Mr. John B. Leiberg in the Cœur d'Alene Mountains, and Prof. Louis F. Henderson in the Salmon River Mountains. Mr. Leiberg's general report on the botany of the Cœur d'Alenes, which contains a large amount of valuable information, particularly on the timber conditions of the region, will soon be transmitted for publication. The data contained in Professor Henderson's report have been

filed for use in connection with further work, which it is proposed to carry on in the mountains of the same State. In the present season Mr. Leiberg has begun a careful survey of the plains of southeastern Oregon to connect with and complete his work of 1893 and 1894 in the plains of eastern Washington and middle Oregon.

PUBLICATIONS.

Six numbers of the Contributions from the United States National Herbarium have been issued during the year, one bulletin of the Division of Botany, three circulars, and five articles from the Yearbook, making altogether 615 printed pages.

These publications are enumerated in detail as follows:

Pure Seed Investigation. By Gilbert H. Hicks. Reprint of pp. 389–408, Yearbook of the United States Department of Agriculture, 1894.

Contributions from the United States National Herbarium, vol. 3, No. 3. Flora of the Sand Hills of Nebraska. By P. A. Rydberg. Issued September 14, 1895.

Contributions from the United States National Herbarium, vol. 3, No. 4. Report on a Collection of Plants Made by J. H. Sandberg and Assistants in Northern Idaho in the Year 1892. By John M. Holzinger. Issued November 23, 1895.

Contributions from the United States National Herbarium, vol. 3, No. 5. Report on Mexican Umbelliferæ, mostly from the State of Oaxaca, Recently Collected by C. G. Pringle and E. W. Nelson. By John M. Coulter and J. N. Rose. Descriptions of Plants, mostly new, from Mexico and the United States. By J. N. Rose. Issued December 14, 1895.

Circular No. 3, revised edition. The Russian Thistle. By Lyster H. Dewey. Issued December 17, 1895.

Contributions from the United States National Herbarium, vol. 3, No. 6. Botany of Yakutat Bay, Alaska. By Frederick Vernon Coville. With a field report by Frederick Funston. Issued January 15, 1896.

Bulletin No. 17. Legislation against Weeds. By Lyster H. Dewey. Issued January 25, 1896.

Contributions from the United States National Herbarium, vol. 3, No. 7. Preliminary Revision of the North American Species of Echinocactus, Cereus, and Opuntia. By John M. Coulter. Issued April 1, 1896.

Circular No. 6. Standards of the Purity and Vitality of Agricultural Seeds. By Gilbert H. Hicks. Issued May 15, 1896.

Some Additions to Our Vegetable Dietary. By Frederick V. Coville. Reprint of pp. 205–214, Yearbook of the United States Department of Agriculture, 1895.

Oil-Producing Seeds. By Gilbert H. Hicks. Reprint of pp. 185–204, Yearbook of the United States Department of Agriculture, 1895.

Testing Seeds at Home. By A. J. Pieters. Reprint of pp. 175–184, Yearbook of the United States Department of Agriculture, 1895.

Two Hundred Weeds: How to Know Them and How to Kill Them. By Lyster H. Dewey. Reprint of pp. 592–610, Yearbook of the United States Department of Agriculture, 1895.

Report of the Chief of the Division of Botany. By Frederick V. Coville. Reprint of pp. 159–164, Report of the Secretary of Agriculture for 1895.

Contributions from the United States National Herbarium, vol. 3, No. 8. Flora of the Black Hills of South Dakota. By P. A. Rydberg. Issued June 13, 1896.

MISCELLANEOUS WORK.

The preparation of our exhibit at the International and Cotton States Exposition, Atlanta, Ga., consumed a large amount of time that would otherwise have been devoted to investigations. Most of the Department exhibits at Atlanta were drawn largely from exhibits made by the Department of Agriculture at Chicago in 1893, but in the case of the Division of Botany none of the Chicago material was available for that purpose. It was necessary, therefore, to prepare an entirely new exhibit, a work which, together with the necessary supervision at Atlanta, required the whole time of one assistant for five months

and of two other assistants for shorter periods. In none of these three cases was the salary of the assistant paid from the exposition fund, and in general it is true that the special appropriations for exposition purposes are so far from adequate that the preparation of exhibits often draws heavily on the regular Department resources.

In the correspondence of the division 3,325 letters have been written and copied, in addition to an indefinite number of printed circulars and other publications sent out in reply to letters of inquiry on special subjects.

In compliance with a general order relative to divisional mailing lists, to the effect that only educational institutions, agricultural experiment stations, libraries, foreign exchanges, and persons cooperating in the work of the division could hereafter receive the publications regularly, a revision of our mailing list was made. Since a valuable part of the operations of the Division of Botany depends upon collated information received from the botanists of the country, the object of revision was to insure a corps of reliable botanical correspondents. A duplicate set of cards from the revised alphabetical list, rearranged geographically by States, counties, and towns, is now used as a correspondence list in securing any required botanical data from a particular locality.

In the fall months of 1895, in response to the urgent requests of gentlemen interested in maintaining the game industries of the Chesapeake Bay region, a preliminary investigation was made of the food plants of the wild duck—what they are, under what conditions they increase or decrease, and what means may be taken for their artificial propagation. This investigation, in which the facts thus far brought out are interesting and valuable, has not yet been completed.

All the official correspondence of the Division of Botany since its organization in 1869 has been bound up in convenient file cases, so as to be easily accessible. This mass of correspondence contains a large amount of material of value as a partial record of the progress of botanical science in the United States during the past quarter-century, and should be placed where it is not liable to destruction by fire.

NEEDS OF THE DIVISION.

In the last annual report attention was called to the need of a botanical artist who should be a permanent member of the division staff, and preliminary steps have now been taken to secure a competent man through the Civil Service Commission. Similar steps have also been taken to secure a man of scientific horticultural training to take charge of certain parts of our seed investigation work. In addition to these wants, which are now in a way to be satisfactorily met, the Division of Botany is in need of a building and of a reference collection of economic plants.

BUILDING.

It seems hardly necessary to repeat the statements of former years relative to the need of better quarters. So far as the possibilities of the present buildings permit, we are fairly well provided for, but the disadvantages of inconvenient situation, the wide separation of laboratory, greenhouse, and main office, the cost of extra messenger service, together with bad ventilation, and the possibility that valuable records, apparatus, books, and collections may at any time be destroyed by

fire, still demand for their elimination the construction of a modern building. This need is so much felt by nearly all other branches of the Department that it is unnecessary to go further into our special requirements.

COLLECTION OF ECONOMIC PLANTS.

While the National Herbarium was still in the custody of the Department it was used as a basis for the comparison of any plants requiring identification, illustration, or description. But those collections are notably deficient in horticultural varieties and the various cultivated plants with which the Department has to deal, while, furthermore, the present situation of the herbarium in the National Museum building renders it inconvenient for quick consultation. The necessity has arisen therefore for a good reference collection of economic plants, containing particularly weeds, poisonous and medicinal plants, native plants useful as foods, fibers, dyes, etc., and all cultivated plants and their horticultural varieties—in brief, a collection suitable for ready reference in the various investigations now in progress.